WE CLAIM:

1. A process for the manufacture of a sensor, comprising the steps of:

providing a substrate;

forming one or more channels in one or more surfaces of the substrate; and

disposing a conductive material in the one or more channels to form one or more electrodes, thereby producing a product sensor.

~~2. A process for the manufacture of a sensor, comprising the steps of:~~

~~providing a substrate;~~

~~disposing a conductive material on one or more surfaces of the substrate by non-impact printing to form one or more electrodes, thereby producing a product sensor.~~

2 ~~3~~. A process for the manufacture of a sensor, comprising the steps of:

providing a substrate;

providing a film or sheet comprising conductive material; and

transferring the conductive material from the film or sheet to the substrate to form one or more electrodes, thereby producing a product sensor.

5 ~~4~~. The process of claim 2, ~~wherein said non-impact printing comprises piezo jet or ink jet printing, electrophotographic, magnetographic, or ionographic printing.~~

a 4 ~~5~~. The process of claim 3 ~~claims 1-3~~, wherein the substrate is provided in a sheet-fed process.

a 7 ~~6~~. The process of claim 3 ~~claims 1-3~~, wherein the substrate is provided as a continuous web.

8 ~~7~~. The process of claim 7 ~~6~~, further comprising the step of:

removing the product sensor by cutting the sensor from the web.

59

9 ~~8.~~ The process of claim ~~6,~~ 7 further comprising the step of:

removing the product sensor by pressing the sensor from the web.

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10 ~~9.~~ The process of claim 34 ~~claims 1-3,~~ wherein the substrate comprises a non-conducting plastic or polymeric material.

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11 ~~10.~~ The process of claim 34 ~~claims 1-3,~~ wherein the substrate comprises a polycarbonate, polyester, or copolymer thereof.

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12 ~~11.~~ The process of claim 34 ~~claims 1-3,~~ wherein the substrate comprises glycol-modified polyethylene terephthalate.

13 ~~12.~~ The process of claim 1, wherein said forming one or more channels comprises mechanically pressing the one or more channels into the substrate.

14 ~~13.~~ The process of claim 1, wherein said forming one or more channels comprises mechanically pressing the one or more channels into the substrate with an embossing tool.

15 ~~14.~~ The process of claim ~~13~~ 14, wherein the embossing tool comprises an embossing stamp.

16 ~~15.~~ The process of claim ~~13~~ 14, wherein the embossing tool is formed of etched silicon, steel, sapphire, epoxy, or ceramic.

17 ~~16.~~ The process of claim ~~13~~ 14, wherein said forming one or more channels comprises forming a pattern of channels, and the embossing tool comprises a pattern of raised portions adapted to press the pattern of channels into the substrate.

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~~17~~ 18. The process of claim ~~13~~ 14, further comprising the step of:

heating the substrate or the embossing tool prior to mechanically pressing.

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~~18~~ 19. The process of ~~claims 1-3~~ claim ~~96~~ ~~4~~ 3, further comprising the step of:

forming perforations in the substrate, the perforations coinciding with a planform of the product sensor.

~~19~~ 20. The process of claim 1, wherein said forming one or more channels comprises laser cutting the one or more channels in the substrate.

~~20~~ 21. The process of claim 1, wherein said forming one or more channels comprises forming one or more channels on one surface of the substrate.

~~21~~ 22. The process of claim 1, wherein said forming one or more channels comprises forming one or more channels on each of two surfaces of the substrate.

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22. The process of claim 1, wherein said disposing of conductive material comprises applying a liquid comprising conductive material to the one or more channels.

~~23~~ 24. The process of claim ~~22~~ 23, further comprising the step of:

wiping excess liquid from the surface of the substrate.

~~24~~ 25. The process of claim ~~23~~ 24, wherein said wiping comprises wiping with a coating blade.

Sub a2

25. The process of claim 1, wherein said disposing of conductive material comprises

applying the conductive material dissolved in a solvent or dispersed in a dispersant to the one or more channels; and

removing the solvent or dispersant from the applied conductive material to form a conductive trace in the one or more channels.

61

27 ~~26~~. The process of claim 1, wherein said disposing of conductive material in one or more channels comprises filling the channel with a liquid comprising conductive material, by wiping, spraying, coating, flooding, applying with a saturated roller, or pumping methods.

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28 ~~27~~. The process of claim ~~26~~ ~~4~~ 3 ~~claims 1-3~~, further comprising the step of:

disposing a non-leachable sensing layer on at least a portion of the conductive material to form one or more working electrodes.

29 ~~28~~. The process of claim 28 ~~27~~, further comprising the step of:

providing an electron transfer agent disposed in or on the sensing layer.

30 ~~29~~. The process of claim 28 ~~27~~, wherein said disposing of a sensing layer comprises applying the sensing layer to the conductive material using an ejected droplet process.

31 ~~30~~. The process of claim 28 ~~27~~, wherein said disposing of a sensing layer comprises applying the sensing layer to the conductive material by a piezo jet printing process.

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32 ~~31~~. The process of claim ~~26~~ ~~4~~ 3 ~~claims 1-3~~, wherein the conductive material comprises carbon or metal.

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33 ~~32~~. The process of claim 1, wherein the conductive material is applied to the channel as a conductive ink or paste.

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34 ~~33~~. The process of claim ~~26~~ ~~4~~ 3 ~~claims 1-3~~, wherein the conductive material comprises gold, silver, or copper.

62

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34. The process of claims 1-3, wherein the conductive material comprises a binder, and the process further comprises the step of:

curing the binder in the one or more channels.

35. The process of claim 1, wherein the conductive material is applied to the channels as a liquid precursor.

36. The process of claim 31, wherein said conductive material is applied as multiple applications of the liquid precursor.

37. The process of claims 1-3, further comprising the step of applying a membrane layer over the one or more electrodes.

~~38~~ 39. The process of claim ~~37~~ 38, wherein the membrane layer comprises a mass transport limiting layer.

~~39~~ 40. The process of claim ~~37~~ 38, wherein the membrane layer comprises an interferent eliminating layer.

~~40~~ 41. The process of claim ~~37~~ 38, wherein the membrane layer comprises a biocompatible layer.

~~41~~ 42. The process of claim ~~37~~ 38, wherein the membrane layer restricts transport of oxygen to the working electrode.

~~42~~ 43. The process of claim ~~37~~ 38, wherein said applying a membrane layer comprises applying a micro-porous membrane as a membrane web to the surface of the substrate.

63

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43. The process of claim 37, wherein said applying a membrane layer comprises applying a micro-porous membrane as a membrane sheet to the surface of the substrate.

44. The process of claim ~~37~~ 38, wherein said applying a membrane layer comprises applying a membrane layer over at least two surfaces of the substrate.

45. The process of claims 1-3, further comprising the step:
forming an enlargement at one end of the one or more electrodes, the enlargement forming one or more contact pads.

46. The process of claim 45, wherein when the one or more electrodes are formed on two surfaces of the substrate, vias are formed at one or more of the enlargements to form the one or more contact pads on one surface of the substrate.

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47. The process of ~~claims 1-3~~ claim ~~46~~ 43, wherein said disposing of a conductive material forms a conductive trace having a width of 250 μm or less.

48. The process of claim 47, wherein said disposing of a conductive material forms a conductive trace having a width of 100 μm or less.

Sub B1

49. The process of claim 48, wherein said disposing of a conductive material forms a conductive trace having a width a width of 50 μm or less.

50. The process of claim 1, wherein the one or more channels has a depth of 75 μm or less.

51. The process of claim 50, wherein the one or more channels has a depth of 50 μm or less.

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52. The process of claim 52, wherein the one or more channels has a depth of 25 μm or less.

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53. The process of claim ~~46~~ 3 ~~claims 1-3,~~ wherein the substrate has a thickness in the range of 50 to 500 μm.

54. The process of claim 53, wherein the substrate has a thickness in the range of 100 to 300 μm.

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55. The process of claim ~~46~~ 3 ~~claims 1-3,~~ wherein the product sensor comprises an electrochemical sensor.

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56. The process of claim ~~46~~ 3 ~~claims 1-3,~~ wherein the product sensor comprises a oxygen sensor.

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57. The process of claims 1-3, wherein at least one of said one or more electrodes comprises a temperature sensor.

58. The process of claims 1-3, wherein said product sensor is adapted for *in vivo* use.

59. The process of claims 1-3, wherein said product sensor is adapted for *in vitro* use.

60. The process of claim 59, wherein said product sensor is adapted for *in vitro* measurement of an analyte in a sample of 1 microliter or less.

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60 ~~61~~. The process of claim ~~46~~ 3 ~~claims 1-3~~, wherein said product sensor is adapted for subcutaneous use.

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62. The process of claims 1-3, wherein said forming one or more electrodes comprises forming a plurality of electrodes on a surface of the substrate.

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~~63~~ 62. The process of claim ~~62~~ 61, wherein said plurality of electrodes is formed on one surface of the substrate.

~~64~~ 63. The process of claim ~~62~~ 61, wherein said plurality of electrodes is formed on two surfaces of the substrate.

a ~~65~~ 64. The process of ~~claims 1-3~~ claim ~~96~~ ~~4~~ 3, wherein said disposing conductive material forms a density of conductive traces on the substrate in the approximate range of 150 to 700 μm per trace.

~~66~~ 65. The process of claim ~~65~~ 64, wherein said density is about 667 μm per trace or less.

~~67~~ 66. The process of claim ~~65~~ 64, wherein said density is about 333 μm per trace or less.

~~68~~ 67. The process of claim ~~65~~ 64, wherein said density is about 167 μm per trace or less.

Sub a7 ~~69. The process of claims 1-3, wherein said forming one or more electrodes comprises forming a plurality of conductive traces on the substrate with a distance between conductive traces of 150 μm or less.~~

~~70~~ 69. The process of claim ~~69~~ 68, wherein the distance between conductive traces is 50μm or less.

Sub a8 ~~71. The process of claims 1-3, further comprising the step of bonding a membrane layer to a surface of the substrate to cover the one or more electrodes.~~

~~72~~ 71. The process of claim ~~71~~ 70, wherein said bonding is by solvent bonding, adhesive bonding, laser bonding, laser welding, or sonic welding.

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72 ~~73~~. The process of claim 21 ~~72~~, wherein said bonding is by solvent bonding.

~~74. The process of claims 1-3, wherein said forming one or more electrodes comprises forming first and second electrodes, the first electrode corresponding to a working electrode and the second electrode corresponding to a counter electrode.~~

a 73 ~~75~~. The process of claim ~~46~~ 43 ~~claims 1-3~~, wherein the substrate is flexible.

a 74 ~~76~~. The process of claim ~~46~~ 43 ~~claims 1-3~~, wherein the sensor is formed in a batch of at least 100 sensors.

75 ~~77~~. The process of claim 74 ~~76~~, wherein the sensor is formed in a batch of at least 1000 sensors.

a 76 ~~78~~. The process of claim ~~46~~ 43 ~~claims 1-3~~, further comprising assigning a code to the sensor.

77 ~~79~~. The process of claim 76 ~~78~~, wherein said assigning a code to the sensor comprises printing the code on the sensor.

a 78 ~~80~~. The process of claim ~~46~~ 43 ~~claims 1-3~~, wherein disposing the conductive material comprises nonleachably disposing the conductive material.

a 79 ~~81~~. The process of claim ~~46~~ 43 ~~claims 1-3~~, further comprising disposing a membrane layer over the substrate to reduce a temperature dependence of the sensor.

a 80 ~~82~~. The process of claim ~~46~~ 43 ~~claims 1-3,~~ further comprising disposing an anticlotting agent on the substrate.

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81 ~~83~~. The process of claim ~~96~~ ~~34~~ 3 ~~claims 1-3~~, further comprising disposing a biocompatible hydrogel over a portion of the substrate that is to be implanted in an animal.

82 ~~84~~. The process of claim 1, wherein at least one channel with conductive material disposed therein is formed on each of two sides of the substrate and further comprising forming a contact pad for each channel with conductive material.

83 ~~85~~. The process of claim ~~84~~ 82, wherein forming a contact pad for each channel comprises forming a contact pad on a first side of the substrate for each channel with conductive material and forming a via between each channel on a second side of the substrate and a corresponding contact pad, the via comprising conductive material to electrically couple to the conductive material in the channel and the corresponding contact pad.

84 ~~86~~. A process for the manufacture of an electrochemical sensor, comprising the steps:

providing a substrate;

forming first and second channels in the substrate;

disposing a conductive material within the channels to form a working electrode located at the first channel, and a counter electrode located at the second channel; and

disposing a sensing layer on the working electrode to produce an electrochemical sensor.

85 ~~87~~. The method of claim ~~86~~ 84, further comprising the steps of forming a first contact pad depression at an end of the first channel and a second contact pad depression at an end of the second channel, and filling the first and second contact pad depressions with conductive material.

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86 ~~88~~. A process for the manufacture of a sensor, comprising:

providing a substrate; and

forming a working electrode on a surface of the substrate via transfer of a conductive material onto the substrate in an image of a conductive trace

87 ~~89~~. The process of claim 86 ~~88~~, wherein forming a working electrode comprises forming the image of the conductive trace on a drum by selective electrical attraction of the conductive material to the surface of the drum and contacting the surface of the drum and the substrate to leave the conductive trace on the substrate.

88 ~~90~~. The process of claim 86 ~~88~~, wherein forming a working electrode comprises forming the image of the conductive trace on a drum by selective magnetic attraction of the conductive material to the surface of the drum and contacting the surface of the drum and the substrate to leave the conductive trace on the substrate.

89 ~~91~~. The process of claim 86 ~~88~~, wherein forming a working electrode comprises providing a print head, interposing a sheet having conductive material between the print head and the substrate, and selectively pressing, according to the image of the conductive trace, the print head and sheet against the substrate to transfer the conductive material disposed on the sheet onto the substrate.

90 ~~92~~. The process of claim 86 ~~88~~, wherein forming a working electrode comprises disposing a curable coating onto the substrate, patterning the curable coating to form channels on the substrate, and disposing the conductive material into the channels on the substrate.

91 ~~93~~. The process of claim 86 ~~88~~, wherein forming a working electrode comprises ejecting conductive material onto the substrate according to the image of the conductive trace.

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92 ~~94~~. The process of claim ~~88~~ 86, wherein forming a working electrode comprises forming at least one conductive trace on each of two surfaces of the substrate, wherein one of the conductive traces forms the working electrode.

93 ~~95~~. The process of claim ~~88~~ 86, wherein forming a working electrode comprises forming a plurality of conductive traces on a surface of a substrate, wherein one of the conductive traces forms a working electrode.

Sub B3

4 ~~96~~. ~~A process for the manufacture of a planar, flexible, electrochemical sensor adapted for *in vivo* use, the process comprising the steps of:~~

~~disposing a conductive material on one or more surfaces of a substrate to form two or more electrodes comprising a working electrode and a counter electrode; and~~

~~forming a product sensor comprising the substrate having disposed thereon the two or more electrodes, the product sensor having a width in the range of about 500 μm (10 mil) to about 2500 μm (50 mil).~~

94 ~~97~~. A process for the manufacture of a flexible, planar sensor adapted for *in vivo* use, comprising the steps of:

disposing conductive material on a first face of a substrate to form one or more electrodes thereon; and

disposing conductive material on a second face of a substrate to form one or more electrodes thereon; and

forming the substrate into a product sensor.

a 4 ~~95~~ ~~98~~. The process of claim ~~96~~ ~~4~~ 3 ~~claims 1-3~~, wherein said disposing of conductive material is at a rate of approximately 5000 conductive traces per hour.

a 5 ~~96~~ ~~99~~. The process of claim ~~96~~ ~~4~~ 3 ~~claims 1-3~~, wherein a catalyst, for catalyzing a reaction of an analyte, is disposed in the conductive material.

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~~100~~ ~~94~~ 95. The process of claim ~~96~~ ~~4~~ 3 ~~claims 1-3~~, further comprising disposing a contact pad on the substrate and in operatively coupled to the working electrode, the contact pad comprising a non-metallic material to reduce corrosion of the contact pad.

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~~101~~ ~~95~~ 96. The process of claim ~~96~~ ~~4~~ 3 ~~claims 1-3~~, further comprising forming two or more conductive traces from the conductive material for use in providing a shock to a user of the sensor when a threshold level of an analyte is exceeded.

71